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Examining the Relationship Between the Perceived Adequacy of Tools and Equipment and Perceived Competency to Teach Agricultural Mechanics

OP McCubbins[1], Trent Wells[2], Ryan G. Anderson[3] & Thomas H. Paulsen[4]

Abstract

Agricultural mechanics holds an important place in agricultural education programs. Teacher efficacy in regards to teaching agricultural mechanics is also important. We used a questionnaire to survey agricultural education teachers in Iowa regarding agricultural mechanics. Spearman Rho correlations were used to determine the magnitude of the relationship between teachers' perceived competency to teach agricultural mechanics skills and the adequacy of tools and equipment available to teach agricultural mechanics skills in school-based agricultural education (SBAE) programs. Correlations between tool adequacy and perceived competency to teach agricultural mechanics skills were identified as statistically significant ($p < .05$) in all 54 content areas addressed within the instrument. The results of the present study aligned with prior research regarding perceived competency and available teaching resources. The possibility exists that a lack of competency in a given skill area may result from, or may result in, a lack of adequate tools and equipment available to teach within that particular skill area. Perhaps the converse is instead true. We recommend that program stakeholders work to ensure that teachers are competent, and have access to adequate tools and equipment necessary, to teach agricultural mechanics.

Keywords: Agricultural mechanics; agricultural education; teacher competency; tool and equipment adequacy; self-efficacy

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It should be noted that this manuscript is part of a larger study that examined agricultural mechanics education within the state of Iowa. The demographics data have previously been published as an objective in Wells et al. (2013) and Shultz et al. (2014). The frequencies for perceived competency to teach have been previously reported in Shultz et al. (2014) and the frequencies for perceived adequacy of tools and equipment have been previously reported in McCubbins et al. (2016). However, within the present study, we are only reporting the mean scores of perceived competency to teach and perceived adequacy of tools and equipment in order to establish the direction for this manuscript.

[1] OP McCubbins is an Assistant Professor in the College of Agriculture and Human Ecology at Tennessee Tech University, Box 5034, Cookeville, TN 38505, omccubbins@tntech.edu

[2] Trent Wells is a Graduate Assistant in the Department of Agricultural Education and Studies at Iowa State University, 223C Curtiss Hall, Ames, IA 50011, ktw0004@iastate.edu

[3] Ryan G. Anderson is a Professor and Chair of the Agriculture Department at Sauk Valley Community College, 173 Illinois Route 2, Dixon, IL. 61021, ryan.g.anderson@svcc.edu.

[4] Thomas H. Paulsen is an Associate Professor and Chair of the Department of Applied Agricultural and Food Studies at Morningside College, 109 Buhler Rohlfs Hall, Sioux City, IA 51106, paulsent@morningside.edu

Introduction

According to Phipps, Osborne, Dyer, and Ball (2008), laboratory instruction, particularly agricultural mechanics, is an important component of the total school-based agricultural education (SBAE) program. Agricultural mechanics coursework has historically been considered an important and necessary construct of the secondary agricultural education curriculum (Burris, Robinson, & Terry, 2005; Wells, Perry, Anderson, Shultz, & Paulsen, 2013). Rosencrans and Martin (1997) found that 69% of secondary teachers believed that stand-alone courses in agricultural mechanics were critical components of agricultural education programs. Roberts, Harder, and Brashears (2016) indicated that agricultural education, in order to provide high-quality instruction, must have access to adequate resources. Providing secondary students with adequate opportunities to acquire necessary technical competencies in agriculture is challenging, especially in the agricultural mechanics curriculum (Burris et al., 2005; Wells et al., 2013).

McKim and Saucier (2011) found that agricultural mechanics competencies were embedded within approximately 60% of the secondary agricultural education curricula from nine states. Meanwhile, Rudolphi and Retallick (2011) found that 90% of agricultural education teachers in Iowa had taught, at the minimum, some agricultural mechanics content within their coursework. When considering agricultural mechanics, the content and responsibilities associated with delivering instruction are vast (Saucier, Vincent, & Anderson, 2014). In turn, this requires a variety of tools and equipment in order to successfully deliver instruction. Moreover, teachers need to be competent in a wide variety of topics that would be covered in an agricultural mechanics course. Common topics within the agricultural mechanics course could include, but are not limited to electricity, various types of welding, soil and water, small engines, tractors and power equipment, and woodworking (Phipps et al., 2008). Due to the wide variety of topics that can be included within an agricultural education program, there is a need for an extensive assortment of tools. Furthermore, this broadly defined program of study requires additional instructor skills which pertain to obtaining and inventorying teaching materials, shop tools, and equipment (Connors & Mundt, 1999).

In teacher education preparation programs, preservice teacher candidates have found it difficult to obtain the competency level necessary to adequately teach subject matter pertaining to agricultural mechanics (Burris et al., 2005). This concern is magnified with recent attempts to limit the quantity of required credit hours for program completion; teacher preparation programs often find it difficult to include enough technical competency preparation for preservice teachers (Burris et al., 2005; Robinson, Krysher, Haynes, & Edwards, 2010). Dillard (1991) stated that it can be difficult to produce prepared teachers of agricultural mechanics with a minimal requirement of agricultural mechanics course work in teacher preparation programs. This can be a potential problem when future teachers enter the classroom. Because post-secondary educational pursuits can be influenced by experiences developed during secondary education, this lack of experience in agricultural mechanics education for agricultural education majors could hold considerable influence over the content areas that future teachers choose to address in the curriculum (Wells et al., 2013).

There is a need for developing competent agricultural education teachers in the area of agricultural mechanics (Burris et al., 2005; McCubbins, Anderson, Paulsen, & Wells, 2016; Saucier et al., 2014; Shultz, Anderson, Shultz, & Paulsen, 2014; Wells et al., 2013). Teachers who may not feel competent a given content area, or do not have adequate tools or equipment to teach agricultural mechanics, may be providing a disservice that is rooted at the university level and further entrenched within secondary programs. As illustrated by McCubbins et al. (2016), a lack of tools and equipment with which to teach can potentially have a negative impact on the learning experiences provided within agricultural mechanics' classrooms. Teacher efficacy in regard to teaching agricultural mechanics, because of the breadth of this component, is also important. Tschannen-Moran and Woolfolk Hoy (2002) found that the availability of teaching resources has a considerable effect on teacher efficacy. In addition, teachers' sense of self-efficacy has a dramatic impact on performance (Tschannen-Moran & Hoy, 2002). Several studies found that teacher self-efficacy is a significant factor in teacher retention (Darling-Hammond, Chung, & Frelow, 2002; Evans & Tribble, 1986). Moreover, could the self-efficacy of an agricultural education teacher lead to the lack of adequate tools and equipment to teach those content areas?

In order to develop and improve teacher competency within a content area, such as agricultural mechanics, both preservice and inservice training should reflect a broad spectrum of necessary skills and knowledge (Shultz et al., 2014; Wells et al., 2013). From a historical perspective, The National Research Council's Committee on Agricultural Education in Secondary Schools Board on Agriculture (1988) stated that "teacher preparation and inservice education programs must be revised and expanded to develop more competent teachers, in and about agriculture" (p. 7). Additionally, no literature was found that explores correlational relationships between tool adequacy and perceived competence to teach a selected skill or set of skills within agricultural mechanics. How can the profession better prepare preservice secondary agricultural education teachers to offer and operate efficient and effective programs that include skills-based courses, such as agricultural mechanics? Determining correlational relationships between the perceived adequacy of available tools and teachers' perceived competency to teach agricultural mechanics could provide direction for improving or designing post-secondary agricultural education degree programs.

Theoretical Framework

Bandura's theory of self-efficacy was used to guide this study (Bandura, 1997). Self-efficacy is one's thinking about personal ability to complete a given task and/or goals. Self-efficacy determines how a person reacts and interacts with their surroundings, environment, situation and people. When teachers feel they have a high sense of self-efficacy in a particular area, they may feel more confident in sharing the knowledge. When looking at the variety of situations in which agricultural education teachers are involved, perceived self-efficacy plays a vital role. Perceived self-efficacy is concerned not with the number of skills one exhibits, but what one believes can be done through a variety of circumstances (Bandura, 1997). Self-efficacy is gained through mastery experiences, physiological and emotional arousal, vicarious experience, and social persuasion (Bandura, 1997). As such, increases in self-efficacy come from a variety of experiences. Burris, McLaughlin, McCullogh, Brashears, and Fraze (2010) found that teachers' self-efficacy improved as the number of years of teaching experience increased. As such, Burris et al. (2010) also noted that confidence in teaching the content in selected areas of SBAE (e.g., agricultural mechanics) increased due to greater exposure over time, lending support to the notion that increases in experience can bring about higher levels of self-efficacy.

Bandura (1997) stated that there is a marked difference between possessing sub-skills and being able to integrate them into appropriate courses of action and to execute them well under difficult circumstances (p. 37). Bandura also stated "the stronger the perceived self-efficacy, the more active the efforts" (p. 194). One can know how to do a variety of specified skills or tasks, but actually having the ability to perform them is vital. An agricultural education teacher's level of self-efficacy regarding agricultural mechanics topics can affect his or her self-perceived competency. Understanding these concepts, we operationalized Bandura's theory of self-efficacy (1997) in our study as the perceived competency to properly teach agricultural mechanics content within a secondary classroom when using the tools and equipment available to teach the skill areas.

For example, if a teacher does not feel as though he or she can teach how to sweat a pipe, there is an increased chance that the teacher will decide against teaching this plumbing skill. If a teacher decides to eliminate all or part of a subject that contains the hands-on skills, will they also make the decision to not purchase the tools and items needed for that subject or particular skill set? Further, if tools and equipment necessary to teach selected topics were not available or were in limited quantity at a given point in time, does the possibility also exist that those topics may be foregone within the instructional decision-making process? Perhaps an examination of the relationship between perceived teacher competency and perceived tool and equipment adequacy is appropriate to help shed light on these questions.

Purpose and Objectives

The purpose of this study was to examine correlational relationships between the perceived adequacy of tools and equipment available to teach a given skill and the perceived competency of agricultural education teachers to teach a specific skill within agricultural mechanics. This study aligned with Priority Area 5: Efficient and Effective Agricultural Education Programs of the American Association for Agricultural Education's (AAAE) National Research Agenda (NRA) (Roberts et al., 2016) which described the need for the development of future agricultural industry personnel to enter into the "human capital pipeline" (p. 42). Further, Roberts et al. (2016) stated that, "[t]he use of laboratory facilities remains a consistent focus of school-based agricultural education programs" (p. 44). As agricultural mechanics content is focused on both laboratory instruction (Burris et al., 2005) and its use in workforce development, it is vital that agricultural education teachers should be competent in addressing the skills taught within the curricula (Shultz et al., 2014; Wells et al. 2013) and have access to an adequate supply of tools and equipment to teach with (McCubbins et al., 2016). As such, the following objective was identified to guide this study: Determine if a correlational relationship exists between the perceived adequacy of tools and equipment available to teach and perceived competency to teach agricultural mechanics topics in school-based agricultural education (SBAE) programs.

Methods

This descriptive study was conducted as part of a larger study in agricultural mechanics education and utilized survey research methods to summarize characteristics, attitudes, and opinions to accurately describe a norm (Ary, Jacobs, Razavieh, & Sorensen, 2006). A paper-based questionnaire was used to address the objectives of this study. Three sections which included 54 skills relating to agricultural mechanics formed the instrument. The 54 skills were separated into five constructs within the subject area of agricultural mechanics and included: Mechanic Skills, Structure and Construction Skills, Electrical Skills, Power and Machinery Skills, and Soil and Water Skills. Respondents were asked to use a five-point summated scale to rate their perceptions of the adequacy of their program's tools and equipment available to teach each skill in secondary agricultural education, as well as their perceived competency to teach each skill. Section two consisted of 15 demographic questions relating to the teacher, and section three included nine questions about the agricultural education program and various school characteristics.

Content validity was reviewed by a team of five university faculty members with expertise in the fields of agricultural mechanics and agricultural education. An initial electronic version of the instrument was pretested through a pilot study with a group of 12 agricultural education teachers in a nearby state following the recommendations of Dillman, Smyth, and Christian (2009). Suggestions from this pilot study led us to adopt a paper-based, rather than electronic, instrument. Post-hoc reliability was estimated following the suggestions of Gliem and Gliem (2003) and resulted in reliability coefficients for both perceived adequacy and perceived competency.

Reliability coefficients for perceived tool and equipment adequacy within each construct were calculated as follows: Mechanic Skills (α = .953), Structure and Construction Skills (α = .956), Electrical Skills (α = .956), Power and Machinery Skills (α = .970), and Soil and Water Skills (α = .898). Likewise, reliability coefficients for perceived competency to teach within each construct were calculated as follows: Mechanic Skills (α = .948), Structure and Construction Skills (α = .960), Electrical Skills (α = .948), Power and Machinery Skills (α = .975), and Soil and Water Skills (α = .849). Per George and Mallery (2003), the Mechanic Skills, Structure and Construction Skills, Electrical Skills, and Power and Machinery Skills constructs were regarded as *Excellent*, while the Soil and Water Skills construct was rated as *Good.*

The sample was chosen under convenience sampling guidelines and data were collected from attendees during a recent Iowa agricultural education teachers' conference. The purpose behind targeting this sample was based on the likelihood for them to be involved in additional professional development activities. A questionnaire was distributed to each secondary teacher (N = 130) in attendance and asked that it be completed by the end of the conference. Participants were offered a power tool institute safety curriculum as incentive to complete and return the questionnaire. Instruments were returned from 103 of the 130 attendees, yielding a 79.2% response rate. No additional efforts were made to obtain data from non-respondents. Non-response error was addressed following the suggestions of Miller and Smith (1983) by comparing respondents' personal and program demographic data to data from the Iowa Department of Education (2010). No significant differences ($p < .05$) for gender, age, highest degrees held, years of teaching experience, or size of school community between respondents and the general population of agricultural education teachers in Iowa based on a Pearson's χ^2 analysis.

Data were coded and analyzed using PSAW 18.0. Due to the ordinal nature of the data collected in the present study, Spearman Rho correlations were used in this study to examine potential relationships between the perceived adequacy of tools available to teach agricultural mechanics and the teachers' perceived competency to teach those skills. The correlations were interpreted using the Davis Convention (1971) and are outlined as follows: those between .01 and .09 were considered negligible, those between .10 and .29 were low, those between .30 and .49 were moderate, those between .50 and .69 were considered substantial, and those .70 or higher were classified as very strong. Effect size was calculated using a Cohen's d (1988) equation, $d = (m_1 - m_2) / {}^{s}pooled$. Effect sizes were as interpreted as follows: .20 was considered small, .50 was considered medium, and .80 was considered large (Cohen, 1988). Due to the purposively selected sample, findings from this study should be interpreted with care and not extrapolated beyond the target population.

Results

Regarding the teachers within the present study, the typical respondent was male (67.0%), taught in a single teacher program (90%) in a rural community (79.2%), and held a bachelor's degree only (62.1%). Further, the typical respondent had less than ten years of teaching experience (52.5%).

Table 1 displays the Spearman Rho Correlation between the respondents' perceived tool and equipment adequacy for concepts within *Structure and Construction Skills* and respondents' perceived competency to teach those skills, as well as the effect size of the relationship. All correlational relationships between perceived tool and equipment adequacy and perceived teacher competency to teach a specific skill were considered positive ($p < .05$). Per the Davis Convention (1971), all of the correlations were regarded as either moderate or substantial.

Table 1

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Competency to Teach Structure and Construction Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Construction and Shop Safety	89	3.48	1.262	3.84	1.154	.624*	.298
Bill of Materials	88	3.26	1.236	3.62	1.108	.535*	.306
Construction Skills (Carpentry)	87	3.14	1.250	3.38	1.221	.498*	.194
Fasteners	85	2.79	1.196	3.11	1.217	.493*	.195
Wood Working Power Tools	89	3.43	1.196	3.74	1.047	.479*	.275
Selection of Materials	86	3.01	1.111	3.37	1.106	.452*	.324
Wood Working Hand Tools	90	3.37	1.194	3.70	1.125	.415*	.284
Concrete	84	2.71	1.188	3.19	1.240	.414*	.397
Drawing and Sketching	83	2.78	1.200	3.20	1.170	.392*	.354

Note. *p <.05. [1] Davis Convention: .01-.09 = negligible, .10-.29 = low, .30-.49 = moderate, .50-.69 = substantial, .70 or higher = very strong; [2] Cohen's *d*: .20 = small, .50 = medium, .80 = large

Table 2 displays the Spearman Rho Correlation between the respondents' perceived tool and equipment adequacy for concepts within *Mechanic Skills* and respondents' perceived competence to teach those concepts as well as the effect size of the relationship. All correlational relationships between perceived tool and equipment adequacy and perceived teacher competency to teach a specific skill were considered positive ($p < .05$). Per the Davis Convention (1971), all of the correlations were regarded as either moderate or substantial.

Table 2

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Mechanic Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Oxy-acetylene Brazing	87	2.85	1.336	2.81	1.228	.645*	.031
GMAW Welding (MIG)	90	3.51	1.170	4.31	0.923	.620*	.238
Metallurgy and Metal Work	80	2.27	1.166	2.51	1.031	.606*	.217
Plasma Cutting	87	2.98	1.414	3.20	1.170	.580*	.169
Welding Safety	92	3.66	1.202	3.98	1.130	.567*	.257
Oxy-propylene Cutting	79	2.03	1.190	2.44	1.239	.560*	.339
Mechanical Safety	83	2.74	1.373	3.37	1.244	.558*	.482
Cold Metal Work	80	2.16	1.094	2.36	1.014	.553*	.190
Soldering	83	2.35	1.176	2.64	1.131	.551*	.251
SMAW Welding (Arc)	93	3.44	1.241	3.65	1.076	.551*	.181
Hot Metal Work	81	2.10	1.084	2.29	0.998	.548*	.182
Oxy-acetylene Welding	93	3.09	1.231	3.25	1.119	.542*	.142
Tool Conditioning	79	2.29	1.105	2.52	1.075	.516*	.210
Pipe Cut. And Threading	77	2.04	1.160	2.49	1.147	.507*	.390
Oxy-acetylene Cutting	93	3.30	1.190	3.51	1.091	.506*	.184

Table 2 (continued)

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Mechanic Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Computer Aided Design	76	2.00	1.012	1.99	1.125	.473*	.009
GTAW Welding (TIG)	81	2.40	1.465	2.49	1.060	.468*	.070
Plumbing	80	2.05	1.088	2.62	1.118	.446*	.958
Fencing	78	1.85	1.057	2.88	1.091	.331*	.785

Note. *p <.05. [1] Davis Convention: .01-.09 = negligible, .10-.29 = low, .30-.49 = moderate, .50-.69 = substantial, .70 or higher = very strong; [2] Cohen's *d*: .20 = small, .50 = medium, .80 = large

Table 3 displays the Spearman Rho Correlation between the respondents' perceived tool and equipment adequacy for concepts within *Electrical Skills* and their perceived competence to teach those concepts. All correlational relationships between perceived tool and equipment adequacy and perceived teacher competency to teach a specific skill within the subject of *Electrical Skills* were significant ($p < .05$). All effect sizes within the area of *Electrical Skills* were considered small. Per the Davis Convention (1971), all of the correlations were regarded as either substantial or very strong.

Table 3

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Electrical Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Electrical Safety	83	2.71	1.469	3.08	1.324	.723*	.265
Wiring Skills (Switches and Outlets)	86	2.64	1.355	2.98	1.282	.720*	.257
Electrician Tools	85	2.57	1.361	2.89	1.276	.686*	.242
Electricity Controls	84	2.33	1.199	2.58	1.116	.638*	.215
Types of Electrical Motors	81	2.05	1.099	2.43	1.069	.606*	.350
Cleaning Motors	76	1.94	1.073	2.35	1.027	.505*	.390

Note. *p <.05. [1] Davis Convention: .01-.09 = negligible, .10-.29 = low, .30-.49 = moderate, .50-.69 = substantial, .70 or higher = very strong; [2] Cohen's *d*: .20 = small, .50 = medium, .80 = large

Data from Table 4 displays the Spearman Rho Correlation between the respondents perceived tool and equipment adequacy for concepts within *Soil and Water Skills*, and their perceived competence to teach those concepts. All correlational relationships between perceived tool and equipment adequacy and perceived teacher competency to teach a specific skill within the subject of *Soil and Water Skills* were significant (p <.05). The relationship between perceived tool and equipment adequacy and perceived teacher competency to teach *global positioning systems (GPS)* had a moderate effect size (d = .574). All other effect sizes were classified as small (d < .05). Per the Davis Convention (1971), all of the correlations were regarded as either moderate or substantial.

Table 4

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Soil and Water Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Legal Land Descriptions	88	2.78	1.385	3.39	1.207	.608*	.468
Survey Equipment	84	2.15	1.266	2.67	1.060	.513*	.445
Profile Leveling	75	1.79	1.017	2.23	0.981	.499*	.429
Global Positioning Systems (GPS)	85	2.27	1.219	2.89	0.924	.486*	.574
Differential Leveling	76	1.84	1.059	2.31	0.970	.471*	.463

Note. *p <.05. [1] Davis Convention: .01-.09 = negligible, .10-.29 = low, .30-.49 = moderate, .50-.69 = substantial, .70 or higher = very strong; [2] Cohen's *d*: .20 = small, .50 = medium, .80 = large

Spearman Rho correlation between the respondents' perceived tool and equipment adequacy for concepts within *Power and Machinery Skills* and their perceived competence to teach those concepts can be seen in Table 5. All correlational relationships between perceived tool and equipment adequacy and perceived teacher competency to teach a specific skill within the subject of *Power and Machinery Skills* are significant at the alpha level ($p < .05$). A moderate effect size was found in the area of *Power and Machinery Safety* (*d* = .595). Effect sizes for *tractor service* (*d* = .716), *tractor maintenance* (*d* = .776), *tractor overhaul* (*d* = .938), *tractor selection* (*d* = .786), *tractor operation* (*d* = .996), and *tractor safety* (*d* = .887) were large. The largest effect size was found in *tractor driving* (*d* = 1.072). Per the Davis Convention (1971), all of the correlations were regarded as either moderate or substantial.

Table 5

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Power and Machinery Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Small Engine Safety	85	2.88	1.392	3.37	1.231	.538*	.369
Service Machinery	82	2.13	1.120	3.01	1.297	.536*	.725
Power and Machinery Safety	85	2.46	1.332	3.26	1.361	.529*	.595
Machinery Operation	83	2.13	1.113	3.03	1.243	.521*	.765
Tractor Maintenance	82	2.09	1.113	3.07	1.300	.485*	.776
Tractor Selection	79	1.94	1.004	2.77	1.108	.480*	.786
Machinery Selection	81	2.11	1.095	2.89	1.215	.472*	.672
Tractor Overhaul	81	1.94	1.029	2.65	1.172	.456*	.938
Tractor Service	83	2.16	1.142	3.02	1.257	.449*	.716
Small Engine Services - 4 Cycle	85	2.67	1.276	3.27	1.197	.449*	.484
Small Engine Overhaul	83	2.63	1.276	3.14	1.243	.449*	.405
Tractor Operation	81	2.01	1.066	3.19	1.286	.416*	.996
Small Engine Services - 2 Cycle	85	2.55	1.252	3.10	1.083	.386*	.471

Table 5 (continued)

Spearman Rho Correlational Relationships Between the Perceived Adequacy of Tools and Equipment and Perceived Teacher Competency to Teach Power and Machinery Skills by Secondary Agricultural Education Teachers

		Adequacy		Competency			
Skills	*n*	M	*SD*	M	*SD*	Rho [1]	*d* [2]
Tractor Driving	82	2.01	1.117	3.34	1.351	.363*	1.072
Tractor Safety	83	2.22	1.240	3.36	1.329	.325*	.887

Note. *p <.05. [1] Davis Convention: .01-.09 = negligible, .10-.29 = low, .30-.49 = moderate, .50-.69 = substantial, .70 or higher = very strong; [2] Cohen's *d*: .20 = small, .50 = medium, .80 = large

Conclusions, Implications & Recommendations

The purpose of this study was to determine if there was a relationship between respondents' perceived adequacy of tools and equipment and perceived competency to teach agricultural mechanics topics in SBAE programs across Iowa. The results of the present study indicated that a statistically significant, positive relationship exists between these two variables in all 54 of the skill areas in this study. This study aligned with Tschannen-Moran and Woolfolk Hoy's (2002) assertion that teaching resource adequacy and availability (i.e., tools and equipment) can affect teacher perceptions in ability and competency. However, we do wish to emphasize that correlation does not equal causation. We wish to emphasize that an increase in tools and equipment available to teach a given topic does not necessarily result in an increase in competency to teach a given topic, or vice versa. Further, as the participants in the present study represented only a sample of agricultural education teachers in Iowa, there should be no effort to generalize the findings of this research effort to the entire population of teachers.

Regarding the strength of this relationship, it is interesting to note that within several of the skill areas there existed a great deal of congruency between perceived tool and equipment adequacy and perceived competency to teach. For example, several of the skill areas within the *Structure and Construction Skills, Mechanic Skills, and Electrical Skills* constructs described a similarity between their responses in both the areas of perceived tool and equipment adequacy and perceived competency to teach. As such, a possible explanation for this interaction is that perhaps the teachers within the present study selected and purchased tools and equipment to use within content areas that they possessed a degree of competency. Conversely, perhaps these teachers exhibited higher competency to teach content areas in which the tools and equipment were already adequate and suitable (McCubbins et al., 2016). As suggested by McCubbins et al. (2016), a link may exist between the perceived adequacy of tools and equipment to teach a given topic and the perceived importance to teach a given topic. Further research should be conducted to address this potential relationship. The findings within the present study certainly indicated a positive relationship between perceived tool and equipment adequacy and perceived competency to teach.

The possibility exists that a perceived lack of competency in a given skill area may result from, or may result in, a perceived lack of adequate tools and equipment available to teach within that particular skill area. Perhaps the converse is instead true. In several skill areas (i.e., *GMAW welding*, *fencing*, *differential leveling*, *power and machinery safety*, and *machinery operation*), notable discrepancy existed between perceived competency and the perceived adequacy of tools and equipment to teach the selected skills. Could this be due to gaps in knowledge to perform versus the actual number of tools and equipment with which to perform? More specifically, respondents' perceived level of competency was greater than their perceived level of tool and equipment adequacy in 52 of the 54 skill areas (the exceptions were in *oxy-acetylene brazing* and *computer-aided design (CNC)*). Does the present study imply that the teachers had the competency to teach a topic, but were limited due to a lack of tools and equipment to address the skills related to the topic? As agricultural mechanics is a popular foundational and important content area within SBAE (Burris et al., 2005; McCubbins et al., 2016; Rosencrans & Martin, 1997; Rudolphi & Retallick, 2011; Saucier et al., 2014; Shultz et al., 2014; Wells et al., 2013), these questions deserve further consideration.

The notion that teachers' perceived competency in a selected content or skill area may affect perceived tool and equipment adequacy, or vice versa, aligns well with Bandura's theory of self-efficacy (1997), as he stated that, "the stronger the perceived self-efficacy, the more active the efforts" (p. 194). As teacher self-efficacy is important in regard to teacher development (Darling-Hammond et al., 2002; Evans & Tribble, 1986), perhaps this has been true with the agricultural education teachers within the present study as well. It is conceivable that these teachers may have focused more effort and time into agricultural mechanics content in which they perceived a greater level of competency. As a result, the tool and equipment adequacy within these selected areas may have increased due to more proactive efforts that were rooted in greater perceived competency and self-efficacy (Bandura, 1997). This idea is supported by the findings of Burris et al (2010), who noted that teachers' content and teaching efficacies improve over time, particularly in agricultural mechanics. Further, it is also possible that these teachers focus greater effort into selected content areas within agricultural mechanics due to their own experiences at the secondary and post-secondary levels, as described by Wells et al. (2013). Thus, as current inservice teachers and teacher educators are preparing the next generation of teachers, great care should be exercised to ensure that the successive generations of agricultural education teachers are well-prepared to teach agricultural mechanics curricula through positive experiences, adequate mechanics-related skill development, and teacher education training (Burris et al., 2005; Wells et al., 2013).

Regarding inservice teachers, efforts should be made to ensure that agricultural mechanics laboratories and curricula are up-to-date and reflect current needs, trends, and student interests. As indicated within the present study, perceived competency in a particular subject appears to have a relationship with the materials (i.e., tool and equipment) necessary to teach the selected content. Thus, stakeholders within agricultural education programs (school administrators, local advisory committees, teachers, agricultural industry representatives etc.) should work to ensure that program teachers are competent and comfortable with the content and have access to the necessary items, such as reasonable budgets or professional development in agricultural mechanics, in order to successfully teach within the agricultural mechanics curriculum. Inservice teachers should take advantage of development opportunities as they arise and work to address shortcomings in order to boost and maintain program quality (Phipps et al., 2008).

Within the realms of teacher education and professional development, state agricultural education leaders as well as teacher educators should work to ensure that appropriate agricultural mechanics training is available and emphasized for both preservice and inservice teachers. As many of the aforementioned stakeholders may work closely with locally- and nationally-based industry representatives, it is recommended that efforts be made to share with teachers' opportunities to acquire training on tool and equipment operation and usage, where and how to locate additional quality tools and equipment, and when industry representatives are offering incentives and savings for acquisition by educational entities. Such efforts can be very beneficial for teachers who may need to enhance the adequacy of their tools and equipment as well as provide opportunities for industry-based professional development.

Regarding university-level training, post-secondary agricultural mechanics coursework should be updated to reflect the changing areas of need related to instruction, facilities management, etc., while professional development should mirror changing technologies, needs related to instructional strategies, and other topics as deemed necessary (Wells et al., 2013). School administrators should work to ensure that teachers have access to professional development as well. Through serving as a gatekeeper for a local program teacher, local administration should be supportive of teacher education and growth to help expand program offerings and improve educational opportunities for students (Phipps et al., 2008).

Regarding research, future efforts should focus upon developing greater understanding of the role of preservice teacher education upon future choices made during inservice teaching. Such knowledge would help to inform the profession about the impact that teacher education programs have upon teacher candidates and their success during their teaching careers. Also, growth in the research body should be directed toward studying the impact that access to quality instructional materials (i.e, curriculum, teaching methodologies, tools and equipment, etc.) play upon teacher self-efficacy, program development, and, ultimately, student achievement. It is also recommended that similar research be conducted that focuses upon other content areas in addition to agricultural mechanics, such as animal science, plant science, etc., to develop a better understanding of the aforementioned concepts in other areas of agricultural education. As a primary goal of agricultural education is prepare life-long learners who are well-equipped to achieve in the real world (Phipps et al., 2008; Roberts et al., 2016), educational practices and research should focus upon this end goal as a guiding light.

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